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Variability of soil properties within large termite mounds in South Katanga, DRC – origins and applications.

Hans Erens (1), Basile Bazirake Mujinya (1,2), Pascal Boeckx (3), Geert Baert (1,4), Florias Mees (1,5), and Eric Van Ranst (1)

(1) Laboratory of Soil Science, Ghent University, Belgium, (2) Laboratory of Soil Science, University of Lubumbashi, Democratic Republic of Congo., (3) Isotope Bioscience Laboratory (ISOFYS), Ghent University, Belgium., (4) Department of Plant Production, University College Ghent, Belgium., (5) Department of Geology and Mineralogy, Royal Museum for Central Africa,Tervuren, Belgium

The miombo woodlands of South Katanga (D.R. Congo) are characterized by a high spatial density of large conic termite mounds built by Macrotermes falciger (3 to 5 ha-1). With an average height of 5.05 m and diameter of 14.88 m, these are some of the largest biogenic structures in the world. The mound material is known to differ considerably from the surrounding Ferralsols. Specifically, mound material exhibits a finer texture, higher CEC and exchangeable basic cation content, lower organic matter content, and an accumulation of phosphorous, nitrate and secondary carbonates. However, as demonstrated by the present study, these soil properties are far from uniform within the volume of the mound. The termites' nesting and foraging activity, combined with pedogenic processes over extended periods of time, generates a wide range of physical, chemical, and biological conditions in different parts of the mound. Analysis of samples taken along a cross-section of a large active mound allowed generating contour plots, thus visualizing the variability of soil properties within the mound. The central columns of three other mounds were sampled to confirm apparent trends.

The contour plots show that the mounds comprise four functional zones: (i) the active nest, found at the top; (ii) an accumulation zone , in more central parts of the mound; (iii) a dense inactive zone, surrounding the accumulation zone and consisting of accumulated erosion products from former active nests; and (iv) the outer mantle, characterized by intense varied biological activity and by a well-developed soil structure. Intermittent leaching plays a key role in explaining these patterns.

Using radiocarbon dating, we found that some of these mounds are at least 2000 years old. Their current size and shape is likely the result of successive stages of erosion and rebuilding, in the course of alternating periods of mound abandonment and recolonization. Over time, termite foraging combined with limited leaching results in the mounds becoming nutrient sinks. As the mounds contain over 1000 m^3 ha-1 of soil, they represent a considerable part of the total nutrient budget of the ecosystem. A recent development in the Lubumbashi region is the advent of large-scale pivot-irrigated agriculture. The termite mounds in new fields are completely leveled, thus dispersing the accumulated nutrients. Our study predicts short- and long-term effects of termite mound spreading on soil fertility.